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BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

CONTROL OF LODGEPOLE NEEDLE MINER
BY SPRAYING

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MEMORANDUM ON THE CONTROL OF THE LODGEPOLE NEEDLEMINE

Examinations of the 1935 control experiments:

The visit of Dr. R. G. Roark, Chief of the Division of Insecticide Investigations and authority on insecticides, was utilized to the fullest extent in detailed discussions and analyses of the problems concerned with the control of the lodgepole needlemine. He visited the Porcupine Control area on June 26-28, 1936 and examined spray plots and experimental trees. On June 30 and July 1 Dr. DeLeon of the National Park Service joined the writer in making a thorough examination of all sprayed areas and experimental trees.

It is too early to obtain visual evidence of the amount of control of the needlemine that may have resulted from the 1935 work. The few counts it was possible to make this spring showed that mortality on a few experimental trees was high. However, it also was evident that there had been a high rate of natural mortality on unsprayed samples.

Reexamination of the experimental trees that were sprayed in 1933 satisfied all observers that the treatments had been of considerable benefit in helping to retain a full complement of undamaged foliage. Figure 1 illustrates the effects of the 1933 work. The two branches on the right were sprayed with a 4% light medium oil emulsion. The two branches on the left are from an adjacent unsprayed tree. The differences between the two sets of branches illustrate the type of protection it is hoped can be secured by the more extensive field applications of sprays.

Dr. Roark concurred in our belief that oil sprays are the logical ones to be used and added that other substances such as nicotine sulfate and pyrethrum extracts, when mixed with the oil, may add considerably to the efficiency of the applications. Once the problems of application of effective materials and of protection of plant and animal life from injury have been worked out by adequate research, there appears to be no reason why satisfactory control practices cannot be applied.

Our experience with oil sprays during the 1935 season was that, if applications are followed by periods of high temperatures, some foliage injury may result. A slight amount of injury did occur following the applications on plots 4 and 10. However, examinations made in the spring of 1936 indicated that, if injury from this cause ordinarily is no more severe or general than that suffered on the sprayed plots, the results will not be objectionable.

Winter burn of foliage:

In the spring of 1936, Mr. Carlsten of the Division of Forestry of the National Park Service reported injury of another type had appeared on the sprayed plots during the winter period. Examination showed that this injury was confined to the needles and that it probably would be temporary in its effects. No injury to buds or twigs could be found. The damage is not the direct result of the spray applications although they undoubtedly were secondarily responsible. It was apparent that certain other factors must have been effective before injury resulted.

It is extremely difficult to point to the primary factor or factors. Spotty applications by inexperienced neeslemen may have been an important factor. This is illustrated by Figure 2 which shows an injured group of reproduction, close to the point at which the neesleman stood when spraying. Trees farther away from the nozzle showed no injury. It may be that adjustable nozzles would help, as the force of the spray on nearby foliage may be involved. However, spotty applications or force of the spray cannot be considered primarily at fault. Similarly the deposition of an excessive amount of oil on the needles does not appear to be involved, for some trees on which it is known excessive amounts of spray were applied showed no injury. Similarly, adjacent trees, such as the two pictured in Figure 3, showed extreme variability in susceptibility to injury although they apparently received similar applications. It was not evident that double coverage was a factor in causing the damage. Similarly, time of application of the sprays appeared to have no relation to the amount of damage. The amount of spray applied per tree or per unit of area could not be correlated with the amount of injury.

It is possible that the quick breaking type of emulsion that was used in the 1933 work may be partially to blame. No injury resulted from the 1933 and 1934 applications nor from one series of tests made in 1935 in which slower breaking emulsions were used.

It appears that climatic conditions during the winter period may contain the real cause of the damage. The spotted occurrence of the burning and the lack of correlation with details of the applications all point to that conclusion. However, in the case of sprayed trees it also is apparent that the applications undoubtedly weakened the trees to the point where the natural environmental factors were effective. That spraying is not necessarily a factor in causing winter injury is shown by some groups of reproduction along the margins of meadows near Tenaya Lake. In that area a winter burning of some individual trees occurred. Fungus organisms may cause a similar needle kill, although spray applications are not involved in any way. At Empire Meadows the needle burning is fully as severe and extensive as that on the sprayed areas and, in addition, has resulted in the death of burs and twigs. Conditions in that area are shown in Figure 4. Less extensive damage of the same type was found near Aspen Valley. In both areas an unknown fungus organism appeared to be the only and primary cause of the injury.

Estimates of the intensity of injury:

The following table gives our estimates of the intensity of injury on experimental trees sprayed in 1935. The 1935 reports entitled "Control of the Lodgepole Needleminer, an RSC Project of the Yosemite National Park", and "Experiments in the Control of the Lodgepole Needleminer, Season of 1935", should be referred to for plot and tree locations as well as for dates of application and composition of the sprays.

TABLE I

ESTIMATES OF INJURY TO EXPERIMENTAL TREES					
No injury	Very slight injury	Slight injury ::	Approaching Objectionable injury	Objectionable injury	Extreme injury
25, 26, 27	30, 34, 35	70, 72, 79 ::	89, 90, 84	76, 92, 98	93
28, 29, 31	54, 78, 86	90, 95, 96 ::	89, 91, 102	104, 105,	
32, 33, 36	97, 99, 100	::		106	
37, 38, 50	101, 107	::			
51, 52, 53		::			
55, 56, 57		::			
58, 68, 69		::			
71, 73, 74		::			
75, 77, 80		::			
81, 82, 83		::			
85, 87, 88					
94, 103					

(Line of division between allowable and objectionable injury)

It should be noted that over half of the trees showed no injury whatsoever. But 13 of the 65 trees showed injury that can be considered objectionable.

On the plots the injury was, for the most part, spotted. Accordingly, the estimate of intensity of injury, as given in Table II is an average. Inasmuch as even occasional groups of severely injured trees might make the injury objectionable from the standpoint of the Park Service, a statement on that point is included in the table.

TABLE II

INTENSITY OF INJURY TO TREES ON SPRAYED PLOTS

Plot number	Estimate of average injury	Remarks
1	Light (spotted)	Allowable
2	Light (spotted)	Objectionable in eastern portion of plot
3	Light (spotted)	Allowable except for a few trees
4	Practically no injury	Allowable
5	Heavy	Objectionable - extreme in spots
6	Practically no injury	Allowable - but two trees slightly affected
7	Heavy (uneven)	Objectionable
8	Heavy (more even than 7)	Objectionable
9	Heavy (like 8)	Objectionable
10	Heavy medium	Objectionable - bad in southern portion
11	Medium (spotted heavy)	Objectionable
12	Light medium	Objectionable in east half of plot Allowable in west half of plot
13	Light (spotted)	Objectionable in spots
14	Medium (spotted)	Objectionable in spots

The occurrence of this injury long after such injury should have appeared introduces a complication into the control problem. The causes should be investigated by further experimental work. This complication is one that could not have been foreseen from the results of previous work.

Recommendations for future work:

A detailed knowledge of the location of infested areas and of the intensity of infestations is necessary before a control program can be arranged. At a recent meeting with members of the Division of Forestry of the National Park Service at Yosemite preliminary plans were made to provide that knowledge by means of systematic surveys. These plans provide for the following activities:

1. Mapping of all susceptible stands in the park
2. Organization of these areas into logical control units
3. Determination of the priority of susceptible areas in a control program on a basis of use and the Park Service protection policy
4. Determination of the extent and intensity of current needleminer infestations by surveys.
5. Study of the effects of needleminer infestations on the health of infested trees in order to determine the critical point

Due to the press of other projects that already are under way, it will be impossible for the Bureau of Entomology and Plant Quarantine to attempt work on the biological phases of the problem, as much as that work appears to be needed. A check already has been made of the results of the 1935 control work. Other examinations should be made later. Inasmuch as the possibility of injury has appeared to complicate the control problem it is considered advisable to recheck with small scale applications to determine if the injury was the product of unusual winter conditions or can be expected when certain sprays are used. Materials suggested for testing are those that have previously been used. They are as follows:

1. The various grades of kerosene oils in different concentrations
2. Quick breaking vs. slow breaking emulsions
3. Oil and nicotine sulfate

Other substances that have not yet been secured but which might be tested for injury are:

1. Pyrethrum extracts with oil
2. Thiocyanates with oil
3. Pine oils
4. Such others as may be considered to have control possibilities and which meet the requirements of control in park areas

As many applications of the substances listed above as time and materials will allow should be made during September, 1936. Checks of the

results should be made during the spring of 1937. Desirable as it may be to start continued research on the more important phases of the needleminer problem, it is considered advisable to withhold that work until adequate facilities and personnel can be provided for or until a research project can be organized on a recognized basis.

Respectfully submitted,

Berkeley, California
July 8, 1936

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Figure 1

BK97420

Effects of 1933 applications of light medium oil, 4% concentration. Note full complement of foliage on the two sprayed branches on the right, and defoliation effects of needleminer activity on two unsprayed branches on left.



Figure 2

BK97422

Dr. Roark and Mr. Miller, standing about at the point where the nozzlemen stood while spraying, discuss causes of injury to the reproduction in front of them.



(Left) Although many of the trees in this picture suffered some foliage injury, the larger tree under inspection was badly burned. The smaller tree in front of it showed practically no burning of foliage, although it was sprayed at the same time, with approximately the same amount of spray.

(Below) Most of the lodgepole bordering the meadow were severely injured by an unknown fungus. Needles were killed, as were buds and twigs. The upper portion of the large tree in the center of the picture, the dark colored tree on the right, and those on the extreme left were but slightly attacked. Their green foliage was a marked contrast to the red colored foliage of the other trees.

Figure 3

BB9742A



Figure 4

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